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The Assessment of Comparative Advantage of the Non-Ruminant Subsector through Policy Analysis Matrix (PAM) in Peninsular Malaysia

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ABSTRACT

The objective of this study was to assess comparative advantages of the non-ruminant subsector in selected states of Peninsular Malaysia. The study analysed livestock production, namely chicken meat and eggs in three states i.e. Negeri Sembilan, Perak and Selangor. This study used a Policy Analysis Matrix (PAM) to determine whether non-ruminant products have a comparative advantage for production under commercial, medium or small scale farm size. The study demonstrated that Malaysia has a strong comparative advantage in the production of chicken meat compared to the production of eggs. Chicken meat produced on a commercial scale has a DRC ratio of 0.24 while eggs produced on a medium scale have a DRC ratio of 0.26. Both farms have a comparative advantage because their ratio implies that the value added per unit of product is larger than the value of domestic resources used to produce in that unit. According to Tsakok (1990), the level of comparative advantage of each subsector is greatest if the DRC ratio is close to zero. As a result, broiler farms on commercial scale with a DRC ratio of 0.24 have a higher degree of comparative advantage compared to layer farms on a commercial scale with DRC ratio of 0.71 .

Keywords: Comparative advantage, PAM, chicken meat, eggs, farm size

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INTRODUCTION

The Tenth Malaysia Plan (10MP) spelt out policies to increase food production. The government has been promoting and revitalising the agriculture sector to become a

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modern food zone with efficient technology-driven food production, commercial scale farming, farming of new crops, livestock and downstream agricultural activities. The new agricultural programmes demand greater orientation towards more modern and commercial scale production of agro-products to spur domestic food production including livestock products. Similarly, the National Agro-Food Policy (2011-2020) has also spelt out the importance of the livestock industry in Malaysia. It is emphasising the efficiency and competitiveness of the non-ruminant sector as well as its development and improved efficiency.

The policy to increase food production is closely related to free trade agreements that will provide opportunities for agricultural products from foreign countries to conduct trade in Malaysia. Free trade also provides opportunities for Malaysian agricultural products in international markets. The policy of increasing food production is expected to increase the quantity and quality of food products so that Malaysia can compete with other agricultural products from abroad.

The argument behind the idea of free trade basically refers to the concept of comparative advantage and the benefits that can be achieved through specialisation in accordance with comparative advantage. Livestock product is one of the commodities that are freely traded, both as import substitute products and as export promotion products.

THE LIVESTOCK INDUSTRY IN MALAYSIA

The livestock subsector in Malaysia grew 9.25% between January and December 2012. Livestock was contributing around 11.7% to the overall performance of the agriculture sector in 2012. The value-added livestock subsector continued to grow by 7.1% in the period 2001 to 2010, mainly driven by higher production of poultry and beef cattle. The value added for cattle and goat farming increased 8.7% and 16.4% respectively in the same period as a consequence of integrated and commercial feedlot farming as well as the implementation of Livestock Sector Entrepreneurship Transformation Scheme. The production of poultry expanded 8 .3% in the period 2001 to 2010. The introduction and implementation of transferring effective microorganism technology, modern poultry farming as well as incentives for farm enhancement contributed to the increase in poultry production (Economic Planning Unit, Prime Ministers Department, 2014).

Currently, Malaysia is the third largest producer of poultry meat in the Asia Pacific region (MIDA, 2014), contributing to about 5% of the region's total production (Malaysian-German Chambers of Commerce, 2012). Malaysian poultry farming represents the largest proportion of the livestock industry in terms of output value. The 2013 ex-farm production value of poultry eggs was estimated to be RM3.7 billion and poultry meat output was estimated at about RM7.01 billion (Department of Veterinary Services Malaysia, 2014).

These subsectors are operated largely in a commercially-orientated manner and are increasingly managed as private or public limited companies.

The ruminant sector lags far behind with the majority of cattle, goat and sheep still owned by individual farmers who rear these animals as part of their overall rural agricultural activities. The total ex-farm output value of beef was estimated to be about RM1.04 billion and mutton at about RM101.63 million in 2013 (Department of Veterinary Services Malaysia, 2014).

Livestock in Malaysia is dominated by poultry meat, which has the largest share of production with 58%, followed by eggs, pork and beef with a production share of 27%, 10%, and 2% respectively. Among these products, poultry meat production is the largest. In the last five years, the average production of chicken meat has been 1,202.0 metric tonnes. This amount is relatively large compared with the average production of eggs of 566.2 metric tonnes or pork with an average production of 206.0 metric tonnes. In fact, the average production of poultry meat is very large when compared with the average production of beef and goat meat, of which there are only 42.2 and 2.2 metric tonnes respectively (Department of Veterinary Services Malaysia, 2014).

In addition, the level of self-sufficiency for beef, goat, pork, poultry meat and poultry eggs were 29.50%, 12.87%, 93.87%, 101.92% and 114.50% respectively in the year 2012 (Department of Veterinary Services, 2014). The data above show that the number for poultry production has exceeded demand in this country. This condition provides opportunities for poultry products to enter the export trade with the intention of raising foreign exchange for the country. This is in accordance with the theory of trade, where the excess production can be used for exports while a lack of production is met through imports (Tsakok, 1990).

Still related to the goals of the National Agro-Food Policy (DAN, 2011-2020), the transformation of the livestock industry will focus on the development of livestock commercial , production of quality breeds, expansion of Good Animal Husbandry Practices (GAHP) and the production of animal feed of quality at competitive prices. Moreover, some aspects of R & D in terms of animal disease control and efficiency of livestock systems will be emphasised. Therefore, the question is whether Malaysia has the comparative advantage in the production of broiler and layer products?

THE POLICY ANALYSIS MATRIX

This study aimed to determine the comparative advantages of the poultry sector in Malaysia. The Policy Analysis Matrix (PAM) methodology was used as an analytical tool for investigating which poultry subsector i.e. egg or broiler had comparative advantage. According to Yao (1997) and (Morrison, 2002) the structure of the PAM can be described as a product of two accounting identities: one defining profit as the difference between revenues and costs and the other measuring the effects of divergence (distorting policies and market

failures) as the difference between observed parameters and parameters that would exist if the divergences were removed. The primary objective of constructing a PAM is to derive a few important policy parameters for policy analysis. In this paper, four most commonly used parameters were derived:

i.) Nominal Protection Coefficient of Output (NPCO)

ii.) Nominal Protection Coefficient of Input (NPCI)

iii.) Effective Protection Coefficient (EPC)

iv.) Domestic Resource Cost (DRC) ratio

The PAM as presented in Table 1 had three rows. The first row of the PAM was calculated using private prices or financial prices. Private prices are those actually received or paid by the economic actors. The second row was a calculation based on social prices (economic prices), which describe the price or social value of the economic value for the elements of cost and performance. The third row was the calculation of the price difference in private cost and the social cost as a result of the impact of government policies or existing market distortions.

The first row of the PAM was the calculation of private profitability (D), defined revenue (A) minus total costs (B+C), where, B and C were foreign and domestic inputs, respectively (Table 1). In other words, the first row of the PAM contained the value for the accounting identity measured at private prices, which are the prices actually used by local producers to purchase their inputs and sell their outputs. Private profitability in the first row demonstrated the competitiveness of the poultry production system, given current prices for inputs, outputs and policies. The second row of the PAM calculated the social profit that reflected social opportunity costs. Social profits measured efficiency and comparative advantages. Social profitability (H) measured revenue valued at social prices minus value of foreign and domestic inputs both valued as social prices. A positive social profit indicated that the system used scarce resources efficiently and contributed to national income (Nelson, 1991). The negative social profits indicated social inefficiencies and suggested that production at social cost exceeded the cost of import. In other words, the sector cannot survive without government support when social profits are negative. The final row of the PAM represented the extent to which policies distort revenues and costs from international levels.

The PAM framework can also be used to calculate important indicators for policy analysis. These include NPCO, NPCI, EPC and DRC. The Nominal Protection Coefficient measures the impact of commodity specific price interventions such as import tariffs. The NPCO is given by the ratio of private revenue to social revenue (A/E). An NPCO greater than one implies that the domestic output is protected and vice versa, if the ratio is less than one. The NPCI is expressed as B/F (the ratio of value of tradable inputs at local market prices or private prices to value of

tradable inputs at world market prices or social prices). The EPC measures the total effect of government interventions; it can be computed from the PAM as a ratio of value added in local market prices (A-B) to the value added in world prices (E-F). If EPC is greater than one, it indicates that government intervention has favoured local production although it is more economical to import the commodity (Legese, 2007).

The DRC is the ratio of the domestic of production in social values (G) to value added again in social terms (E-F). It indicates the cost of domestic factors that have to be incurred to obtain one unit of value added in social terms. A DRC value between zero and less than one implies that the commodity has a comparative advantage while a value above one and those negative indicate that an activity is wasting scarce resources that could be used efficiently elsewhere (Mahlanza *et al*., 2003).

DATA AND GENERAL ASSUMPTION

The study used both secondary and primary data. The secondary data were obtained from various resources such as from the Department of Statistics, Department of Veterinary Services (DVS), Ministry of Agriculture (MOA), Ministry of Finance (MOF) and other related sources. The secondary data were used to understand the industry and to formulate the research issues. The main data for this study came from primary data. Field survey was conducted in late 2012 and early 2013 among poultry farmers. The gathered information took into account the information on the production in the year 2012, such as quantities of farm production outputs and inputs, scale of farm and prices paid and received by producers. The poultry subsector was classified by farm size of commercial, medium and small scale farms as shown in Table 2. Classification of farms size facilitates comparison of the different farm sizes where there are

TABLE 1
Structure of the Policy Analysis Matrix (PAM) Methodology

	REVENUE	COST		PROFIT
		INPUTS TRADABLE	INPUTS NON-TRADABLE	
Private Prices	A	B	C	D = A - B - C
Social Prices	E	F	G	H = E – F - G
Divergence	I = A – E	J = B – F	K = C – G	L = I - J - K= D - H

Source: Pearson, 2003

Note:
A = Revenue in Private Price
B = Inputs Tradable in Private Price
C = Inputs Non-Tradable in Private Price
D = Private Profitability
E = Revenue in Social Price
F = Inputs Tradable in Social Price
G = Inputs Non-Tradable in Social Price
H = Social Profitability
I = Output Transfer
J = Input Transfer
K = Factor Transfer
L = Net Transfer

variations in cost of production and revenue due to the differences in utilisation of resources and the value of output and input.

This survey was implemented in Negeri Sembilan, Perak and Selangor. The location selection was based on the potential resources of livestock in the centre area of livestock products in Peninsular Malaysia. The number of samples used in this survey was39 broiler producers and 18 layer producers in the areas of research. The method of analysis was using the structured questionnaire. The main information collected from the survey was: (1) Livestock reconciliation table and estimation of farm production and (2) Cost profile for each livestock enterprise. The presentation of the livestock reconciliation table was based on the format used by Tan *et al*. (1989). The total physical output for each category was estimated as follows:

a) Broiler Farm

Production = Live weight gain over the production
(per kg of live weight)
= Sales (kg live weight)
+ Home consumption
(kg live weight)
+ closing stock
(kg live weight)
- opening stock
(kg live weight)

b) Layer Farm

Total farm production of the primary product of eggs was equal to sales plus home consumption in egg boxes, where for every single box, there were 30 eggs. Based on the Department of Statistics in Malaysia, every one million eggs is equal to 60 metric tonnes of eggs. This means that every one metric tonne of eggs is equal to 16667 eggs or equal to 556 egg boxes.

The compilation of revenue and production cost profiles collected from the farms was in the private value. These private values need to be converted into social values prior to DRC calculations. Conversion Factors (CF) were used to convert the private values to social values. The CF of a selected item that had a direct involvement in the production of poultry was estimated by using the formula obtained from Veitch M.D (1986). The selected items that the CF needed to estimate were categorised into immediate inputs and primary inputs. The immediate inputs included the following: feed MVS (medicine, vaccines and supplements), livestock purchased, fuel, repair and maintenance, utility and office supplies. The primary inputs included labour, depreciation, interest and land rent. Other items included were TAX, licenses and losses.

*This is the only information available for Conversion Ratio (CR). The Economic Planning Unit (EPU) has not come out with a new conversion ratio.

In addition, the cost of inputs needed to be converted into the domestic and foreign components using conversion ratios. All inputs or outputs that were not being traded across national boundaries of the particular country either because of the cost of production or limited trade practices

were called domestic components. The cost of domestic components is also known as non-tradable cost. On the other hand, all inputs or outputs that were traded if their production and consumption affected the country's level of imports or exports on the margin were called foreign components. The cost of foreign components is also known as tradable cost. The breakdown of domestic and foreign components is presented in Table 4.

TABLE 2
Classification of Poultry Farms

COMMODITY	FARM CLASS	POPULATION
Broiler	Commercial	>130,000 birds/period
	Medium	25,000 - 130,000 birds/period
	Small	<25,000 birds/period
Layer	Commercial	>90,000 birds/period
	Medium	18,000 - 90,000 birds/period
	Small	<18.000 birds/period

Source: Department of Veterinary Services (DVS), 2012.

TABLE 3
Conversion Factors from Private to Social Analysis*

INTERMEDIATE INPUT			CONVERSION FACTOR
	Feed		0.95
	MVS		0.88
	Livestock Purchase		0.95
	Fuel		0.88
	Repairs & Maintenance		0.78
	Water		0.75
	Electricity		0.84
	Office Supplies		0.90
TAX			0.00
LAND RENT			1.00
LICENCE			0.00
PRIMARY INPUT			
	Labour		0.82
	Depreciation		
		Building	0.86
		Equipment	0.90
		Transportation	0.70
	Interest		1.30
LOSSES			1.00

Source: Veitch, 1986.

TABLE 4
Allocation of Costs Between Domestic and Foreign Components

			DOMESTIC (%)	FOREIGN (%)
Intermediate Input				
	Feed			
		Broiler	20	80
		Layer	20	80
	MVS		20	80
	Repairs & Maintenance		100	0
	Water		90	10
	Electricity		90	10
	Fuel		50	50
	Livestock Purchase			
		Broiler	50	50
		Layer	50	50
	Office Supplies		100	0
Tax			100	0
Land Rent			100	0
Licence			100	0
Primary Input				
	Labour		100	0
	Depreciation			
		Building	100	0
		Equipment	100	0
		Transportation	67	33
	Interest	Building	95	5
Losses			100	0

Source: Veitch, 1986

*This is the only information available for Conversion Ratio (CR). The Economic Planning Unit (EPU) has not come out with a new conversion ratio.

RESULTS AND DISCUSSION

In this study, the Policy Analysis Matrix (PAM) was used to evaluate the comparative advantages of alternative activities, namely broiler and layer subsectors in the Malaysian poultry industry. The most prominent indicators used from the PAM were the Domestic Resource Cost (DRC) ratio and Social Profitability (SP). A simple definition of the DRC is that it measures the ratio of the cost of domestic factors used by the commodity (production) system to the value added of the system, both measured at social prices. In other words, the DRC measures the ratio of the cost of domestic resources used by the commodity system to the value of imported resources created by the commodity system, both measured at social prices.

Similarly, social profits measure efficiency or comparative advantage, although outweighed by the DRC for comparison of different activities. The results can be taken directly from the second row of the PAM matrix, where social profits equal social revenues minus total social costs (domestic and foreign costs).

In addition, the PAM framework can also be used to calculate important indicators for policy analysis. The nominal protection coefficient (NPC), a simple indicator of the incentives or disincentives in place, is defined as the ratio of private price to a comparable world (social) price. NPC can be calculated for both output (NPCO) and input (NPCI). The other indicator is an effective protection coefficient (EPC), which measures the total effect of the government interventions. The summary result of protection coefficients on layers and broilers subsector production are reported in Table 5.

Analysis of Protection

The ratio formed to measure output transfers is called the Nominal Protection Coefficient of Output (NPCO). NPCO shows how much private prices differ from social prices. If NPCO exceeds one, the private prices are higher than the import or export price and thus the industry is receiving protection. If NPCO is less than one, the private price is lower than the comparable world price and the industry is unprotected by policy. As can be seen in Table 5, the NPCO for poultry industry is 1.05 and it indicates that policies have caused domestic output price of the poultry industry in Peninsular Malaysia to be higher than the world price by approximately 5% (Mahlanza *et al*., 2003). In other words, the value of total output was 5% greater than it would have been in the absence of the policy. The condition of the current price of poultry products has indirectly provided an incentive for the development of poultry production in Peninsular Malaysia.

TABLE 5
Analysis of Protection

KIND OF FARM	FARM CLASS	NOMINAL PROTECTION COEFFICIENT OF OUTPUT (NPCO)	NOMINAL PROTECTION COEFFICIENT OF INPUT (NPCI)	EFFECTIVE PROTECTION COEFFICIENT (EPC)
BROILER	Small	1.05	1.05	1.05
	Medium	1.05	1.05	1.05
	Commercial	1.05	1.06	1.05
	All Size	1.05	1.05	1.05
LAYER	Small	1.05	1.05	1.05
	Medium	1.05	1.06	1.05
	Commercial	1.05	1.05	1.05
	All Size	1.05	1.05	1.05

Source: Farm survey, 2012/13.

Ratios, which are free of currency or commodity distinctions, are used to compare among tradable inputs. The ratio formed to measure tradable input transfers is called the Nominal Coefficient on Inputs (NPCI). NPCI shows how much private prices of tradable inputs differ from their social prices. If NPCI exceeds one, the domestic input cost is higher than the input cost at world prices and the system is taxed by the policy. If NPCI is less than one, the private price is lower than the comparable world price and the system is subsidised by the policy (Pearson, 2003). According to evaluation of government protection in Table 5, the NPCI of the Malaysian poultry industry ranged between 1.05 and 1.06. These coefficients suggested that producers were paying 5%-6% more for their tradable inputs than if they had been able to obtain them at their respective social price (Morrison, 2002). This means the policy provided 5%-6% tax per unit of tradable input paid by domestic producers (Joubert, 2000).

The existence of government policy in the form of value added tax on input production in the poultry industry is related to the higher portion of foreign component of the inputs used in the poultry production, especially feed and Medicine Vaccine Supplement (MVS). Both broiler and layer use 80% of the foreign component respectively even as the input MVS for poultry production uses 80% of the foreign component. The higher foreign component used on input has caused the price to rise due to import tariff, which has also created a negative transfer from the entire set of policies affecting tradable inputs.

The Effective Protection Coefficient (EPC) assesses the net effect of different interventions in the market and in doing so recognises that such interventions can either enhance or reduce economic efficiency (Kydd *et al*., 1990). EPC compares the value added in domestic prices with value added in world prices. EPC is another indicator of incentives measured as the ratio of value added at private price to value added at social price (Nakhumwa, 1999). This coefficient measures the net effect resulting from the product market and tradable input and output policies. Table 5 shows that the EPC of the Malaysian non-ruminant industry is 1.05. These coefficients illustrated that the Malaysian poultry industry enjoyed a subsidy of up to 5% for its value added feature (Yao, 1997).

Analysis of Social Profitability

As indicated earlier the basic output from the poultry production can be divided into two main products, broiler and layer farm. Table 6 shows that the social profitability (SP) column for all scale broiler and layer farms were positive SP. These ratios indicated that both broiler and layer farms in Peninsular Malaysia were efficient.

According to Table 6, the broiler farm in commercial scale could produce the highest profits in the poultry subsector. This farm had a ratio of SP of about 2.09, which means that every one kilogram of broiler produced would give a profit of about RM2.09/kg in live weight. Layer farm in the medium scale became superior with the ratio of SP

of about 1.72, which is capable of giving a profit of RM1.72/kg in live weight for every one kilogram of eggs produced. In conclusion, the broiler farm on commercial scale is a more profitable farm that produces the highest profits compared with poultry farms in Malaysia of other sizes.

Analysis of Comparative Advantage

The analysis revealed that overall, the poultry subsector had a comparative advantage in the production of livestock products, especially broiler production on commercial scale and egg production on medium scale. Table 6 shows that broiler farm on commercial scale had a DRC ratio of about 0.24. This ratio means that the farm used US$0.24 domestic resources to produce an output with a value of about US$1. In other words, commercial broiler farms can save US$0.76 of foreign exchange in every broiler produced. Layer farms of medium scale had DRC ratio of about 0.26, which means that the farms used US$0.26 of domestic resources to produce an output with a value of about US$1 and saved US$0.74 of foreign exchange. These indicators suggested that the broiler farm on commercial scale had a degree of comparative advantage higher than that of the layer farm on medium scale. According to Tsakok (1990), the level of comparative advantage of each subsector is greatest if the DRC ratio is close to zero.

A sensitivity analysis was conducted to test the results of the analysis of comparative advantage in the production of the poultry subsector as input prices had increased, especially those belonging to the feed price. It is known that feed cost and the cost of DOC purchased dominate the cost of inputs in broiler production. Commercial broiler production still had a comparative advantage even when feed price was increased by 20% and when the cost of purchased livestock was increased by 20%. Even if both the price of feed and the price of purchase of day-old chicks (DOC) were

TABLE 6
Analysis of Comparative Advantage and Social Profitability

KIND OF FARM	FARM CLASS	SOCIAL PROFITABILITY (SP)	DOMESTIC RESOURCE COST (DRC)
BROILER	Small	0.14	0.89
	Medium	0.31	0.78
	Commercial	2.09	0.24
	All Size	1.98	0.70
LAYER	Small	0.29	0.80
	Medium	1.72	0.26
	Commercial	0.38	0.71
	All Size	0.47	0.66

Source: Farm survey conducted in Peninsular Malaysia, 2012/13.

increased simultaneously by 20%, the commercial broiler production still had a comparative advantage. Table 7 shows the DRC and its sensitivity analysis on price of feed and purchase of DOC.

Broiler production in the medium-sized farms did not have a comparative advantage when feed costs increased by 20%; this was also true when the cost of purchase of DOC increased by 20%. If both feed and DOC costs were increased simultaneously by 20%, the medium broiler production did not have a comparative advantage.

Similarly, the small-sized broiler farms did not have a comparative advantage when feed costs increased by 10% or when the cost of purchase of DOC rose by 10%. An increase in the cost of these two items simultaneously by 10% showed that the small broiler productions did not have a comparative advantage.

The sensitivity analysis showed that increasing feed cost and cost of DOC purchased by up to 20% could eliminate the comparative advantage of broiler productions in the medium- and small-sized farms. However, if both costs increased up to 20% they still could not eliminate the comparative advantage in the commercial broiler productions. Based on the results

TABLE 7
Sensitivity Analysis of Comparative Advantage in Poultry Subsector

FARM SIZE	BROILER		LAYER	
	SENSITIVITY ANALYSIS	DRC	SENSITIVITY ANALYSIS	DRC
All sizes	Normal	0.70	Normal	0.66
	Increased feed cost 20%	1.17	Increased feed cost 20%	1.11
	Increased cost of DOC purchased 20%	0.94	Increased labour cost 20%	0.71
	Increased feed cost 20%+cost of DOC purchased 20%	1.24	Increased feed cost 20%+labour cost 20%	1.13
Commercial	Normal	0.24	Normal	0.71
	Increased feed cost 20%	0.38	Increased feed cost 20%	1.26
	Increased cost of DOC purchased 20%	0.33	Increased labour cost 20%	0.74
	Increased feed cost 20%+cost of DOC purchased 20%	0.49	Increased feed cost 20%+labour cost 20%	1.28
Medium	Normal	0.78	normal	0.26
	Increased feed cost 20%	1.14	Increased feed cost 20%	0.53
	Increased cost of DOC purchased 20%	1.01	Increased labour cost 20%	0.29
	Increased feed cost 20%+cost of DOC purchased 20%	1.28	Increased feed cost 20%+labour cost 20%	0.57
Small	Normal	0.89	Normal	0.80
	Increased feed cost 10%	1.09	Increased feed cost 20%	1.24
	Increased cost of DOC purchased 10%	1.04	Increased labour cost 20%	0.96
	Increased feed cost 10%+cost of DOC purchased 10%	1.15	Increased feed cost 20%+labour cost 20%	1.32

Source: Farm survey conducted in Peninsular Malaysia, 2012/13.

of this analysis it can be concluded that increasing input costs by up to 20% in the commercial broiler production will not cause comparative disadvantages to the commercial-size broiler production.

On the other hand, the total production cost of the layer is dominated by the feed and labour costs. Egg production on the medium-size farms still had a comparative advantage when the feed or labour cost was increased by up to 20%. This production still had a comparative advantage when both costs were simultaneously increased by 20%.

The commercial egg production units still had a comparative advantage when the labor costs were increased by 20%. However, the comparative disadvantage was removed when feed costs were increased by 20%. This production also had a comparative disadvantage when both costs were simultaneously increased by 20%.

The small egg production units still had a comparative advantage when the labour cost increased by 20%. As the feed cost was increased by 20%, this production had a comparative disadvantage. This production also had a comparative disadvantage when both costs were simultaneously increased by 10%.

Based on the results of the sensitivity analysis it can be concluded that even with an increase in labour cost was made by up to 20%, egg production in Malaysia still had a comparative advantage, but the rising cost of feed by up to 20% could eliminate the comparative advantage of layer production on ommercial- and small-size farms. At the same time, the medium-layer farm size still had a comparative advantage despite the increased input costs of up to 20%.

CONCLUSION AND RECOMMENDATIONS

This study applied the PAM on the poultry sector in Peninsular Malaysia. The results showed that Malaysia had a comparative advantage in the production of poultry namely, broiler and layer chicken. Broiler was more efficiently produced on a commercial scale while layer was more efficiently produced on the medium scale.

However, producers need to consider the impact of the increase in feed prices in poultry production. The cost of feed is the largest component in poultry production, taking 68% in broiler and 87% in egg production. Adding to the problem is that 80% of feed cost consists of imported components. This makes it difficult for the Malaysian government to regulate the level of the feed prices because increased imports of feed prices would reduce the level of comparative advantage in the production of poultry products.

As a recommendation, the government needs to advise livestock producers to find or produce alternative feeding stuff. The alternative feeding stuff must use more than 50% of domestic components in order to reduce dependence on imported feed. Furthermore, the government needs to consider building up the animal feed industry and hence, should examine how to produce animal feed from local resources such as PKC (palm kernel cake) more

effectively and efficiently and have a feed conversion ratio as for corn-based feed ingredients.

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